

**QUALITY ASSURANCE PROVISIONS (QAP)
FOR THE
BOMB ASSEMBLY, PRACTICE, BDU-50 C/B**

I. QUALITY SYSTEM REQUIREMENTS

- A. The contractor shall implement and maintain a quality system meeting the requirements of ISO 9002-1994 (or 9001-2000.) The quality system shall also implement the following provisions:
1. Subcontractors producing critical and/or major characteristics shall have a quality system compliant to ISO 9002-1994 (or 9001-2000.)
 2. When property is furnished by the government, the contractor shall implement the following:
 - (a) Examination upon receipt, consistent with practicality, to detect damage upon transit;
 - (b) Inspection for completeness, quantity and proper type;
 - (c) Periodic inspection and precautions to assure adequate storage conditions and to guard against damage from handling and deterioration during storage;
 - (d) Identification and protection from improper use or disposition.
 3. Process and Production Control conditions shall include:
 - (a) Documented manufacturing planning for the implementation and control of manufacturing operations. The planning shall include: a description of operations, facility, environmental equipment, and tooling requirements, associated controls, and a process flow chart to portray the process of fabrication and assembly in terms of key operations.
 - (b) Accountability for all product.
 - (c) Evidence that all manufacturing, test, and inspection operations have been completed in sequence, as planned, or as otherwise documented and authorized.
 - (d) Preparation of documented process monitoring, accountability, and operator instructions for all processes that affect product quality. These instructions are to be accessible at the point where work is performed and shall, as a minimum, contain reference to the following: workmanship standards, manufacturing aids, step by step instructions for performing operations, equipment or tools required, special conditions to be maintained, identification of special handling devices, and methods for recording completion of operations.
 4. The contractor's calibration system shall be in accordance with ANSI/NCSL Z540-1-1994.
 5. Control of nonconforming material shall include:
 - (a) Controls applied to suspect product as well as to nonconforming product.
 - (b) The proposed use or repair of product which does not conform to specified requirements shall be submitted to the government prior to use or repair. Rework and repair shall be in accordance with applicable contract clause. Repetitive nonconformances will not be approved.
 - (c) The contractor shall promptly notify the government when a nonconformance is found in the contractor's processes or products that may affect product already delivered.
 6. Corrective action shall be required of a subcontractor when it is determined that the root cause of a nonconformity is attributable to, and the responsibility of, the subcontractor.
 7. Internal audits shall cover all quality management related processes, activities, and shifts, and shall be scheduled according to an annual plan.
- B. The quality system shall be documented in a Quality System Plan (QSP) in accordance with the applicable CDRL, ADL and this QAP. The QSP shall document the details of the contractor's quality system, including management commitment to quality, system elements, policy and practices. This Plan provides the government a basis for assessment of the quality system and evidence of the contractor's intent to comply with the contract quality requirements.
1. The QSP shall include traceability from the specific quality requirement elements to the specific contractor processes which support those elements. The QSP shall include:
 - (a) A summary of the contract quality requirements and
 - (b) A relational matrix to indicate the general relationship between the contractor's quality system procedures/processes and the applicable quality system elements. The matrix, or an attachment thereto, shall also identify schedules or quality activities and tasks which must be coordinated and compatible with other schedules prepared for work under the contract, as well as include the name(s) of the person(s) responsible for accomplishments of activities and tasks.
 2. The QSP shall identify the means by which the contractor will ensure quality system effectiveness and demonstrate comprehensive management and review of data, such that the results may be used to indicate

trends and progress in quality of design, processes, fabrication, assembly, test and acceptance as appropriate to the contract. The QSP shall describe what is measured, how often it is tracked, and who reviews and assures that appropriate action is initiated when trends are unfavorable.

3. A copy of the contractor's quality manual which describes the current quality system shall be attached.

II. TEST AND INSPECTION REQUIREMENTS

- A. Product characteristics in Table 1 of this QAP shall be tested and inspected to the requirements/criteria and samples specified therein.

- B. All other characteristics shall be tested and inspected to the requirements and sample sizes below:

1. Characteristics classified on the drawings or in separate documents as "CRITICAL" shall be inspected 100%. Inspection and test of CRITICAL characteristics which are first order, single point safety failure modes (nonconformance would cause a catastrophic failure) shall not be reduced.
2. Characteristics classified on the drawings or in separate documents as "MAJOR" shall be inspected by characteristic using MIL-STD-1916, Verification Level (VL)-III (Table II).
3. Characteristics classified on the drawings or in separate documents as "MINOR" shall be inspected by characteristic using MIL-STD-1916, VL-II (Table II).

NOTES:

1. The above criteria will apply except where sampling plans and acceptance criteria appear in the product and/or affiliated specifications, or where authorization to deviate from these requirements has been obtained in accordance with contract requirements.
2. MIL-STD-1916 forms the basis of the sampling inspection program. Those elements of MIL-STD-1916 related to sampling inspection will also apply (e.g., switching rules, nonconformance disposition, etc.) Reduction of test and inspection requirements are defined in Section V.
3. If the use of an alternate sampling plan (other than those specified above) is desired, it shall be documented in detail to show factors such as lot size, sample size, acceptance criteria, and operating characteristic curves, and submitted for approval in accordance with the contract requirements.
4. MIL-STD-1916 is not intended for use with destructive testing. The destructive test sampling requirements are provided in Table 1.

- C. The contractor shall prepare an Acceptance Inspection and Test Plan (ITP) in accordance with the following format herein, and the applicable CDRL. The ITP shall address First Article, Preproduction, and Lot Acceptance inspection and test requirements.

1. General format: The ITP shall, at minimum, contain the following:
 - (a) Cover sheet identifying item, contract number, and revision letter of the plan.
 - (b) All of the tests and inspections required for acceptance of the item, documented in accordance with the requirements herein.
 - (c) A section for gage and measurement equipment maintenance, recertification, and recalibration documented in accordance with the requirements herein.
2. Format for documenting inspections: For each test or inspection, including those tests or inspections which are contained in specifications, specific instructions shall be prepared and shall contain the following:
 - (a) Identification of the item to be tested or inspected, including part number, revision letter, and nomenclature.
 - (b) Identification of measuring and test equipment using appropriate identification data which is visible on the equipment. Standard instruments such as a caliper or micrometer do not require a one to one identification description and can be identified simply as "caliper" or "micrometer".
 - (c) The location of the characteristic, such as the drawing sheet and zone, or a brief description of the characteristic such that an inspector can identify its location.
 - (d) A written procedure for performing the test or measurement when the characteristic is other than a simple plus or minus tolerance dimension which is measured by the use of a standard instrument such as a caliper or micrometer. The procedure may be placed in an appendix of the plan and referenced if the procedure is lengthy or repeatedly used.
 - (e) The manner in which the result of the inspection is to be recorded such as a particular data sheet.
 - (f) Criteria for passing or failing the inspection (such as the high and low limit for a particular dimension, a particular minimum tensile strength, minimum voltage, etc.).
 - (g) Details of the sampling plan to be used.

3. Format for gage maintenance, recertification, and recalibration schedule: For each acceptance gage, or other measurement device used for final acceptance, the following information shall be documented in the ITP:
 - (a) A description of the gage or measuring device, including identification data which is visible on the equipment.
 - (b) A schedule for recertification of the gage or measurement device in terms of gage passes or time limit.
 - (c) Inspection and test equipment used for acceptance of CRITICAL and MAJOR characteristics shall require design approval in accordance with applicable CDRL. A copy of the approval shall be included. Inspection and test equipment used for acceptance of other characteristics (i.e., MINOR) shall require approval in accordance with applicable CDRL. A copy of the approval shall be included.
- D. The above inspection format shall be used for all required tests and inspections regardless of whether the test is performed by a subcontractor. When tests or inspections are performed by a subcontractor, all of the above information shall be provided by the subcontractor or obtained by subsequent receipt inspection or final acceptance inspection by the prime contractor. When tests are performed by a subcontractor, the prime contractor shall review the relevant specifications and create a receipt inspection review sheet to review the subcontractor's inspection and test data to ensure that it conforms to contractual requirements. In-process or statistical production tests, which are used for purposes of manufacturing material, which will later be verified by an acceptance inspection, need not be documented in the plan.
- E. Approved test inspection equipment shall be made available for use by the government when required to determine conformance with contract requirements. If conditions warrant, contractor personnel shall be made available for operation of such devices and for verification of their accuracy and condition.

III. ACCEPTANCE REQUIREMENTS

- A. The contractor shall perform first article, preproduction, and production inspection and tests as described herein.
 1. First article and preproduction components and completed units shall be representative of items to be manufactured during rate production using the same manufacturing facilities, flow processes, procedures, and controls planned for use during rate production. Likewise, inspection and test of first article and preproduction components and completed units shall be performed using the same methods and equipment scheduled for use during rate production.
 2. Materials, design and construction shall be in accordance with the requirements as defined by the contract. The contractor shall demonstrate by means of certification that only materials and components conforming to the contract requirements have been used. Certification statements shall completely identify the material or component, indicate the specification or drawing (revisions and dates) applicable, the grade or type to which the material or components were tested, the number tested and quantitative requirements and results obtained during tests.
 3. First Article and Preproduction Approval:
 - (a) If the sample passes the criteria established in the inspections, tests and verification, it will be approved. If the sample fails any of the specified inspections and tests, the results will be evaluated by the government procuring activity. These results, together with the government engineering analysis of the sample, shall form the basis for corrective action by the contractor. Depending upon the degree of corrective action deemed necessary by the government, approval may be:
 - (1) Granted, in which case the contractor shall have first made the changes required by the government prior to the start of regular production (or preproduction).
 - (2) Withheld, and new sample shall be submitted for approval in place of the failed sample. The sample shall be subjected to the examinations and tests in which the failures occurred and any other examinations and tests of the first article inspection as required by the Procuring Contract Officer (PCO).
 - (3) Withheld, and a new sample shall be submitted for approval.

In all cases the contractor shall comply with the required changes which are within the scope of the contract requirements to the satisfaction of the government for future production (or preproduction).

- (b) Approval, conditional approval, or rejection of the sample will be given by the PCO. Until the sample is approved, further production (or preproduction) shall be at the risk of the contractor. The government

will not proceed with acceptance of the production lot until first article and preproduction approval is granted.

- (c) Additional Samples: Additional samples may be required by the PCO as the result of a first article sample failing to meet the contract requirements. Additional samples required as a result of first article or preproduction failure shall be supplied by the contractor at his own expense.
- (d) Disposition of First Article and Preproduction Sample: All First Article Samples shall be identified, segregated, and retained at the contractor's plant and made available to the government representative, upon request, for the duration of the contract. Final disposition of First Article Sample will be provided prior to contract completion. Preproduction units successfully passing all required tests and inspections, and approved by the government, may be delivered under contract, as directed by the PCO.

- 4. All failures occurring during FAT, Preproduction, or LAT shall be reported by the contractor in accordance with CDRL requirements.
- 5. At conclusion of First Article Testing, Preproduction, and Lot Acceptance Testing, the contractor shall prepare test reports in accordance with CDRL requirements. Data generated during inspection and testing will be included with reports.
- 6. The contractor is responsible for the performance of all inspections and test requirements herein. However, the government reserves the right to perform any of the inspections set forth in this QAP where such inspections and test are deemed necessary to assure products conform to the prescribed requirements.

B. First Article Test (FAT).

- 1. Prior to the start of preproduction, the contractor shall manufacture and submit a first article sample. First article examinations, tests, and inspections shall be performed at the contractor's facility, by the contractor personnel, and witnessed by government representatives, to assure sample conforms to all the requirements specified by the contract (e.g., the ADL, all drawings and related specifications and standards, QAP, Table 1) and accompanied by verifiable inspection results, certified test reports, material certifications, etc.

The first article sample shall consist of:

- (a) Four (4) completed units, three (3) of which will be used for destructive testing.
- (b) Four (4) complete sets of components.

C. Preproduction Test

- 1. Preproduction testing shall not proceed until first article is accepted by the government.
- 2. Preproduction lot size will be 100 units.
- 3. Tests and inspections performed during preproduction shall be in accordance with ADL and this QAP.
- 4. Conformance of preproduction units to ADL and QAP be the basis to proceed to rate production.

D. Lot Acceptance Test (LAT).

- 1. Rate production shall not proceed until the government accepts the results of preproduction units as conforming to the requirements of the ADL and QAP.
- 2. Production lot size shall be no greater than 170 units or one day's uninterrupted production, whichever is less. A lot shall be amenable to stratified sampling as described in Table 1, and the contractor shall indicate whether there are any other parameters of the process contributing to variability that would call for further stratification of the sample. An upper limit of 170 on lot size is specified to limit the sample size, but smaller lot sizes may be more convenient for balanced stratified sampling, depending on the number of bombs per mold and molds poured per treatment.
- 3. Lot acceptance will be conducted by contractor and/or DCMA/QAR and witnessed by DCMA/QAR.
- 4. Lot acceptance will be conducted in accordance with the inspection and test requirements set forth within the technical documentation, this QAP, and the approved ITP.
- 5. Should a failure occur during Lot Acceptance, the contractor shall immediately notify, via the DCMA/QAR, the contracting office prior to any rework/repair and retest or reinspection.

- E. A Quality System Review concurrent with preproduction test/inspection or first lot acceptance test may be conducted to evaluate the contractor's processes and procedures inherent to the quality of items to be delivered under this contract. The review shall be conducted by government representatives designated by the PCO.

IV. STATISTICAL PROCESS CONTROL PROGRAM

The contractor's implementation of the SPC program shall be documented in accordance with the applicable CDRL and contract clause (with scope of work).

V. INSPECTION AND TEST REDUCTION OR ELIMINATION

- A. The government will consider reduction or elimination of acceptance inspection or testing based upon first article, preproduction, and lot acceptance test results when supported by evidence of both process stability and capability. Contractor written requests shall be made through the Administrative Contracting Officer to the PCO. Approval will be based upon the contractor's quality system plan, statistical process control plan, and validation of the implementation of statistical process control techniques and corresponding results. Upon approval by the PCO, acceptance shall be based upon the approved contractor's statistical process control program and associated statistical techniques.
- B. The government will not consider requests for reduction or elimination of 100% acceptance inspection and testing of parameters or characteristics identified as CRITICAL.
- C. The government will consider reduction or elimination of acceptance inspection or test requirements when the following conditions are satisfied:
 - 1. For parameters and characteristics other than CRITICAL when evidence is provided of statistical control and a Cpk of at least 1.33.
 - 2. Objective evidence that statistical control and Cpk continue to be evaluated and maintained.
- D. Evidence of loss of statistical control or degradation below a Cpk of 1.33 shall require immediate corrective action in accordance with the statistical process control program.
- E. Any break in production greater than 90 days shall require a return to normal acceptance inspection and testing.

VI. MAINTAINING PLANS

Plans (e.g., QSP, ITP, SPC) shall be maintained and updated as necessary. Updates (changes/revisions) shall consist of notes or changes to the plan(s), clearly identified as to where applicable (i.e., system element, page, paragraph number, etc.). Updates shall be submitted in accordance with CDRL requirements.

VII. ADDITIONAL REQUIREMENTS

- A. ECPs, VECs, Deviations, and NORs shall be prepared and submitted in accordance with applicable CDRL.
- B. Production progress and Delivery Report (DD Form 375) shall be prepared with instructions listed thereon.
- C. Contractor shall prepare Ammunition Data Cards in accordance with CDRL and deliver with each deliverable lot.

Table 1 - Test and Inspection Requirements

NONDESTRUCTIVE TESTING	DEFINITION/CRITERIA	FIRST ARTICLE	PREPRODUCTION	PRODUCTION
LOT SIZE	QAP, PARA. III	FOUR (4) COMPLETE UNITS FOUR (4) SETS OF PARTS	100 COMPLETE UNITS	NOT TO EXCEED 170 COMPLETE UNITS (SEE QAP, PARA. III.D.2.)
COMPOSITION	ANALYZE FOR C, Si, Mg, Mn, Ni, P, Cr, Mo, Cu, AND S. GOAL COMPOSITION TBD BY FOUNDRY.	⁽¹⁾ IN-MOLD KEEL BLOCK(S) OR INTEGRALLY ATTACHED TEST BAR FROM EACH MOLD.	ONE (1) SAMPLE PER TREATMENT.	ONE (1) SAMPLE PER TREATMENT.
MICROSTRUCTURE	DETERMINE % FERRITE, % PEARLITE, NODULE COUNT, AND NODULARITY IAW ASTM E3 AND A247. GOAL MICROSTRUCTURE TBD BY FOUNDRY.	⁽¹⁾ IN-MOLD KEEL BLOCK(S) OR INTEGRALLY ATTACHED TEST BAR FROM EACH MOLD.	ONE (1) SAMPLE PER TREATMENT.	ONE (1) SAMPLE PER TREATMENT.
TENSILE/KEEL BLOCK	DWG 4512209, NOTE 1.A. SAMPLE MOLD LOCATION, TYPE, AND GEOMETRY SHALL BE THE SAME FOR FIRST ARTICLE, PREPRODUCTION, AND PRODUCTION.	⁽¹⁾ IN-MOLD KEEL BLOCK(S) OR INTEGRALLY ATTACHED TEST BAR FROM EACH MOLD.	⁽¹⁾ IN-MOLD KEEL BLOCK(S) OR INTEGRALLY ATTACHED TEST BAR FROM EACH MOLD.	⁽¹⁾ IN-MOLD KEEL BLOCK(S) OR INTEGRALLY ATTACHED TEST BAR FROM EACH MOLD.
IMPACT	DWG 4512209, NOTE 1.B. TEST THREE (3) SPECIMENS FROM EACH KEEL BLOCK.	⁽¹⁾ IN-MOLD KEEL BLOCK(S) OR INTEGRALLY ATTACHED TEST BAR FROM EACH MOLD.	⁽¹⁾ IN-MOLD KEEL BLOCK(S) OR INTEGRALLY ATTACHED TEST BAR FROM EACH MOLD.	⁽¹⁾ IN-MOLD KEEL BLOCK(S) OR INTEGRALLY ATTACHED TEST BAR. SAMPLING IAW MIL-STD-1916, VL II.
VISUAL	DWG 4512209, NOTE 1.C. AND SAE-AMS-STD-2175 MAGNETIC PARTICLE ACCEPTANCE CRITERIA FOR GRADE C. INSPECT ALL SURFACES AFTER HEAT TREATMENT, DESCALING, AND MACHINING.	100%	100%	100%
DIMENSIONAL	COMPONENT AND ASSEMBLY DWGS.	100%	QAP, PARA. II.B	QAP, PARA. II.B
ULTRASONIC WALL THICKNESS	DWG 4512209, NOTE 11.	100%	ONE (1) RANDOMLY SELECTED BOMB BODY FROM LAST MOLD POURED FROM EACH TREATMENT.	MIL-STD 1916, VL-II
LUG LOAD	DWG 4512207, NOTE 8.	100%	100%	100%
HYDROSTATIC PRESSURE	DWG 4512207, NOTE 9.	100%	100%	MIL-STD-1916, VL-II
MAGNETIC PARTICLE	DWG 4512209, NOTE 1.C.	100%	100%	MIL-STD 1916, VL-III
RADIOGRAPHIC	DWG 4512209, NOTE 1.C.	100%	ONE (1) RANDOMLY SELECTED BOMB BODY FROM LAST MOLD POURED FROM EACH TREATMENT.	MIL-STD-1916, VL-II ONLY ZONED AREAS OF DWG 4512209, NOTE 1.C.
DESTRUCTIVE TESTING	DEFINITION/CRITERIA	FIRST ARTICLE	PREPRODUCTION	PRODUCTION ⁽²⁾
TENSILE	DWG 4512209, NOTE 1.A. DWG 4512205, NOTE 6 AND NOTE 7.	THREE (3) (OF THE 4 BOMB BODIES)	FIVE (5) RANDOMLY SELECTED BOMB BODIES FROM THOSE RADIOGRAPHED.	ONE (1) RANDOMLY SELECTED BOMB BODY
IMPACT/TRANS TEMPERATURE	DWG 4512209, NOTE 1.B. DWG 4512205, NOTE 6 AND NOTE 9.	SAME BOMB BODIES SAMPLED FOR TENSILE TEST.	SAME BOMB BODIES SAMPLED FOR TENSILE TEST.	SAME BOMB BODY SAMPLED FOR TENSILE TEST.
VISUAL/INTERIOR	DWG 4512209, NOTE 1.C. AND SAE-AMS-STD-2175 MAGNETIC PARTICLE ACCEPTANCE CRITERIA FOR GRADE C. DWG 4512205, NOTE 8. INSPECT ALL SURFACES AFTER HEAT TREATMENT, DESCALING, AND MACHINING.	SAME BOMB BODIES SAMPLED FOR TENSILE TEST.	SAME BOMB BODIES SAMPLED FOR TENSILE TEST.	SAME BOMB BODY SAMPLED FOR TENSILE TEST.
DIMENSIONAL/ SECTIONED	DWG 4512209. DWG 4512205, NOTE 8.	SAME BOMB BODIES SAMPLED FOR TENSILE TEST.	SAME BOMB BODIES SAMPLED FOR TENSILE TEST.	SAME BOMB BODY SAMPLED FOR TENSILE TEST.
MICROSTRUCTURE	DWG 4512205, NOTE 6 AND NOTE 7. DETERMINE % FERRITE, % PEARLITE, NODULE COUNT, AND NODULARITY IAW ASTM E3 AND A247. GOAL MICROSTRUCTURE TBD BY FOUNDRY.	SAME BOMB BODIES SAMPLED FOR TENSILE TEST.	SAME BOMB BODIES SAMPLED FOR TENSILE TEST.	SAME BOMB BODY SAMPLED FOR TENSILE TEST.

NOTES:

(1) INTEGRALLY ATTACHED TEST BARS MAY BE USED IN LIEU OF KEEL BLOCKS PROVIDING THE SAME LOCATION, TYPE, GEOMETRY, AND SOLIDIFICATION REPRESENTATIVE SAMPLES ARE USED FOR ALL FIRST ARTICLE, PREPRODUCTION, AND PRODUCTION CASTINGS.

(2) DESTRUCTIVE TESTING OF PRODUCTION CASTING SAMPLES MAY BE PERFORMED PRIOR TO MACHINING. ALL NON-DESTRUCTIVE TESTS, EXCLUDING LUG LOAD AND HYDROSTATIC PRESSURE, SHALL ALSO BE PERFORMED ON THE DESTRUCTIVE TEST BOMB BODIES. DIMENSIONAL INSPECTION OF THE MACHINED FEATURES IS NOT MANADATORY FOR DESTRUCTIVE TEST ARTICLES.